This invention relates to a circular window structure which has numerous meritorious advantages over ordinary windows of other shapes and types.

An object of the invention is to develop a circular window that may be manufactured in a small fraction of the time required for the fabrication of other types of windows, using unskilled labor and simple machinery as well as lightweight inexpensive forms of high-quality materials, or cheap materials, if desired.

Another object is to provide a circular window which is durable and especially resistant to injury or destruction in the presence of vibration or twisting stresses such as occur in the bodies of all vehicles, although it is equally suitable for use in buildings or anywhere that a window is needed or desired. The window embodies also a pleasing and decorative appearance along modernistic lines.

A further object is to provide a window structure that may be factory pre-assembled, and installed without the need for laborious tool-work and hand fitting on the job, thereby eliminating delays and expensive field operations in the installation or replacement of windows of this type.

A further object of the invention is to greatly simplify the window structure by eliminating sash weights, elevating gears, packings, window posts and other internal complications of structure, while at the same time providing for safety of use and ease of operation.

Additional objects are to provide for effective water drainage, weather-tightness, ease of sash or glass replacement, rattle and noise elimination, reduction of weight resulting in new uses and inexpensive shipping and handling, long periods of trouble-free usefulness, and the like.

The foregoing and other objects of more or less importance are attained by the means described herein and disclosed in the accompanying drawing, in which:

Fig. 1 is an elevational rear view of a circular window embodying the present invention.
Fig. 2 is an edge view of the same.
Fig. 3 is an enlarged cross-sectional view taken on line 3-3 of Fig. 1.
Fig. 4 is a fragmental elevational view taken on line 4-4 of Fig. 3.
Fig. 5 is an elevational view of a window sash which forms part of the device of the invention.

With reference to the accompanying drawing, the character 1 indicates the circular frame of the window, which is fabricated of a length of strap metal formed preferably by rolling it to an annular ring formation with the opposite ends joined to produce a complete accurate circle. In order that the circular window frame may be formed quickly and with a minimum of effort, the simple metallic strip which constitutes the frame is by preference fed into a hoop machine which forms all the necessary flanges and angles in a single rolling operation. In this way the window frame may be shaped accurately within a fraction of a minute. Due to the saving in cost resulting from the method employed in fabricating the window frame, it is possible to make use of relatively expensive materials having the advantages of freedom against rust, corroding or tarnishing, as well as high tensile strength, without materially increasing the ultimate cost of the structure. It is therefore obvious that the frame, as well as the sashes of the window structure, may be manufactured inexpensively from ferrous materials such as stainless steel, nickel steel or the like, as well as copper, aluminum, brass and similar materials which in thin strip formation are inexpensive. It is also possible to construct the parts of common materials that may be plated if desired.

The window frame, upon leaving the hoop machine, will comprise a pair of spaced substantially parallel flanges 8 and 9 connected by means of an intermediate portion 10, the inner smooth surface 12 of which provides an annular track along which may slide the rotatable metallic window sash members 13 and 14. A mounting flange 15 for the window frame may be provided during the rolling operation of the strip which forms the window frame, and this may be an annular exterior flange located upon the portion 12 at a position adjacent to the flange 9. It is of course immaterial whether the mounting flange be located elsewhere along the intermediate portion 10 of the window frame.

Any suitable means for mounting the frame upon a supporting structure may be provided, and such means are illustrated herein by way of example, as a series of spaced apertures 16 for the reception of screws, bolts, or other suitable fastening devices. It will thus be evident that the window frame may be fitted to an opening in the wall of a dwelling or other building, or into the bodies of vehicles or other means of transportation, with much less difficulty than is encountered in fitting windows of other shapes.

Within the space between the flanges 8 and 9, the window frame is adapted to receive two or more window sashes 13 and 14 that may be ro-
tated to various positions at which the translucent sheets 17 and 18 will overlap segmentally in the various open positions of the window. Although both sashes may rotate, it is preferred that one of the sashes, 13 for example, be fixed with the frame and rotation. This may be accomplished by the use of any suitable means, such as by fitting tightly into the window frame the sash 13 that is not to be rotated. The other sash 14 may be rotated through 360°, although for practical purposes a 180° rotation is sufficient to rest in opening and closing of the window. Any suitable stop means, not shown, may be provided for limiting the extent of rotation of the movable sash 14.

Each window sash preferably is constituted of a completely circular channel shaped frame comprising spaced parallel legs and an intermediate connecting portion, the space between the legs being directed centerward for reception of any type of translucent sheet 17 or 18, such as a pane of glass or a screen of any desired material. For each window sash 14 having the legs 18 and 20 spaced apart in substantial parallelism and connected by an intermediate portion 21 which is complementary to the accuracy of the track portion 12 of the window frame. At a location on a diameter of said sash 14, there is provided a straight U-shaped channel strip 22 provided with the spaced legs 23 and 24 connected by an intermediate spanning portion 25. The opposite ends of strip 22 are fixed to the frame of sash 14 in any suitable manner, and preferably, though not necessarily, may be removable in order to provide for replacement of the translucent sheet 17. If the strip 22 be fixedly and permanently attached to the sash 14, replacement of a translucent sheet would be effected by removing the sash and sheet as a unit, and replacing the damaged unit with a new one.

As is most clearly indicated in Fig. 5, the translucent sheet 17 is semi-circular, and therefore occupies approximately half the area of the frame. The legs of the strip 22 are coplanar with the legs of the circular sash frame 14. In the case of the rotatable sash 14, the free ends 26 and 27 preferably are not joined, but are rather spaced apart 27 to facilitate application and demounting of the sash relative to the window frame 17, and further to provide a space for the drainage of water from the lower half of the U-shaped strip constituting the window sash 14. In the case of the sash 13, the constituent U-shaped strip preferably is formed as a full circle, with the ends joined by welding, brazing, or otherwise.

It is of importance to note that the flange 28 of the channel strip forming the sash 13 impinges flatwise tightly against the annular flange 8 of the window frame, thereby to furnish a weather-tight joint. The opposite flange 29 tightly contacts the flange 19 of the rotatable sash 14 all around, while the outer flange 20 rides upon the inwardly directed flange 8 of the window frame. The frictional contact of the rotatable sash upon the flanges 3 and 29, while snug, must not be so great as to preclude rotation of the movable window sash 14. The space between the window frame flanges 8 and 9, therefore, is made slightly wider than the combined widths of the window sashes.

It will be noted that Fig. 3 shows a snug contact between the legs 23 and 30 of the sash strips 22 and 31, respectively, providing a weather-tight joint at that point when the window is closed.

With reference now to Fig. 4 and the lower portion of Fig. 3, it should be noted that the outer flange 9 of the window frame is gradually cut away from the frame and rotation. This may be accomplished by the use of any suitable means, such as by fitting tightly into the window frame the sash 13 that is not to be rotated. The other sash 14 may be rotated through 360°, although for practical purposes a 180° rotation is sufficient to rest in opening and closing of the window. Any suitable stop means, not shown, may be provided for limiting the extent of rotation of the movable sash 14.

This characteristic is imparted to the flange 9 at opposite sides of the point 33, as illustrated in Fig. 4. The construction not only provides for water drainage but also enables the window to be opened progressively as shown in Figs. 3 and 4. Once the rotatable sash 14 is thusly removed, sufficient space is afforded within the interior of the window frame to render easy the removal of the remaining sash, even though the latter may not be split as at 26-27. Regardless of this however, there is no reason why the sash 13 could not be similarly split if necessary to further expedite and facilitate removal thereof from the window frame.

When the sashes for the window structure are properly disposed within the window frame, the parts will fit with precision due to the fact that they had been formed in a hoop machine with great accuracy. The window is found to be tight and free of any possibility of rattle or vibration internally, so that its use in vehicles is particularly advantageous. The window frame, being of a single piece of material and shaped as a ring with flanges that reinforce it, is highly resistant to distortion and to becoming bent out of shape, so that the rotatable sash will never bind therein but will always be freely movable for effecting the open and closed window positions. Replacement of windows or sashes is possible within the space of a few moments, as compared with the laborious process and the liability of breakage encountered in the replacement of windows of the conventional type. Not only is the initial cost of the window structure rendered much less than heretofore, but the cost in labor and materials involved in replacing damaged windows is materially reduced.

It may here be stated that replacement may be effected by purchasing replacement sashes already loaded with window panes or other translucent sheets, this constituting a unit for replacement purposes. Thus there is avoided the necessity for hand work and the use of tools in fitting replacement windows, thereby reducing to a practical minimum the skilled labor usually necessary in cases of replacement. Noteworthy also is the complete absence of felt, weather stripping or other pains taking means to preclude rattle and leakage through the windows, as well as the fact that no complex operating mechanism is required such as sash weights, elevating gears,
and the like. It has been determined, moreover, that a window of this type is operative even in the presence of strains tending to distort the window frame by twisting along a diameter thereof, the distortion being evidently due to the fact that all of the constituent principal parts of the window structure are circular and will flex in unison if necessary. Other advantages are referred to in the objects preceding this description, and still others will become apparent to one skilled in the art.

In a more complete form of the invention, the rotatable sash may be provided with stops and handles, which are not necessary, however, to the provision of an operative structure.

It is to be understood that various modifications and changes may be made in the structural details of the device, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. In a window structure of the class described, the combination which comprises an open substantially full-circular window frame comprising a curved metallic strip of channel formation having its ends abutted and permanently joined together, and having a pair of spaced parallel annular flanges directed radially inwardly, with an intermediate annular track disposed between said flanges, one of said flanges being cut away along a limited portion of its circumference to the level of the annular track surface, providing a water escape gutter and a sash releasing port, a pair of pivotless annular ring-shaped metallic sashes each comprising a U-shaped strip of a width approximating one-half of the distance between the frame flanges, the sashes both being seated rotatably between the frame flanges with the opposed legs of the U-strips in flatwise form but sliding contact upon the flanges and upon one another throughout substantially the full circumference of both sashes to furnish a self-sufficient weather seal, the bases of the U-strips riding upon the annular track of the circular frame, and a pair of semi-circular translucent sheets each embraced between the opposed legs of a U-shaped sash strip, for together providing a full closure for the window structure when the sashes are rotated to dispose the sheets in diametrically opposed relationship, the sash which is adjacent to the cut-away portion of the frame being severed transversely at a location opposite to the translucent sheet of that sash, whereby the latter may release accumulated water and be distorted for removal from the frame.

2. As a new article of manufacture, a circular transversely split window sash of U-shaped narrow flexible strip material, said U-shaped strip having opposed spaced legs and an intermediate transverse connecting portion, the latter providing a bearing constituting the extreme periphery of the sash all the way around its circumference, and the legs being directed centerward of the circular sash, and a semi-circular translucent sheet having curved marginal edges flexibly mounted within the space between the legs of the U-shaped strip and occupying approximately half of the area of the sash opening, the ends of the sash at the split being flexible and thereby susceptible to being sprung laterally out of the normal plane of the sash to facilitate application and removal of the sash relative to a circular window frame.

3. As a new article of manufacture, a circular transversely split window sash of narrow flexible strip material U-shaped in cross-sectional configuration, said U-shaped strip having smooth opposed spaced legs normally spaced apart in substantially parallel planes, with a curved connecting portion spanning the legs at their outermost limits, the outer faces of the legs and of the connecting portion providing bearing areas for slidability of the sash against supporting means therefor, the legs of the strip being directed centerward of the circular window frame, and a substantially semi-circular translucent sheet fitted to the strip between the legs thereof and occupying approximately half of the area of the sash opening, the ends of the sash at the split being flexible for temporary displacement laterally out of the spaced legs, one in flatwise sliding contact against the first sash and located opposite to the semi-circular translucent sheet.

4. In a window structure of the class described, the combination which comprises: an open annular window frame of one-piece hoop construction comprising a continuous curved metallic element of channel formation having a pair of spaced parallel annular flanges directed radially inwardly, with a single uninterrupted smooth annular track disposed between said flanges, one of said annular flanges being cut away along a limited portion of its length to substantially the level of said track, a circular window sash fitted to the annular track within the frame, to bear against that annular flange of the frame which is opposed to the one having the cut-away portion, a translucent sheet carried by said sash, and a second circular sash fitted within the frame for rotational movement along the annular track, said second sash comprising a circular transversely split strip of flexible material U-shaped in cross-section, said U-shaped strip having smooth opposed spaced legs, one in flatwise sliding contact against the first sash and the other in sliding contact upon the cut-away flange of the window frame, the legs of the strip being directed centerward of the sash, and a substantially semi-circular translucent sheet fitted to the split strip of said second sash, between the legs thereof, one of the ends of said sash at the split being flexible for temporary displacement out of the normal plane of the sash and through the cut-away portion of the window frame, to guide said sash from its normal position within the window frame for sash replacement purposes.

5. In a window structure of the class described, the combination which comprises: an open annular window frame of one-piece hoop construction including a continuous curved element of channel formation having a pair of spaced parallel annular flanges directed radially inwardly, with a single uninterrupted smooth annular track disposed between said flanges, one of said annular flanges being cut away along a limited portion of its length to substantially the level of said track, a circular window sash fitted to the annular track within said frame, to bear against that annular flange of the frame which is opposed to the one having the cut-away portion, and a second circular sash fitted within the frame for rotational movement along the annular track, said second sash comprising a circular transversely split strip of flexible material U-shaped in cross-section, said U-shaped strip having smooth opposed spaced legs, one in flatwise sliding contact against the first sash and the other in sliding contact upon the cut-away flange of the window frame, the legs of the strip being directed centerward of the sash to em-
brace a translucent sheet of lesser area than said sash, one of the ends of said sash at the split being flexible for temporary displacement out of the normal plane of the sash and through the cut-away portion of the window frame, to guide said sash from its normal position within the window frame for sash replacement purposes.

6. In the window structure of the class described, the combination which comprises: an open annular window frame of one-piece hoop construction, including a continuous curved element of channel formation having a pair of spaced parallel annular flanges directed radially inwardly with a single uninterrupted smooth annular track disposed between said flanges, a circular window sash fitted to the annular track within said frame, to bear against one of the annular flanges of the frame, and a second circular sash fitted within the frame for rotational movement along the annular track, said second sash comprising a circular transversely split strip of flexible material U-shaped in cross-section, said U-shaped strip having smooth opposed spaced legs, one in flatwise sliding contact against the first sash and the other in sliding contact upon the remaining flange of the window frame, the legs of the strip being directed centerward of the sash to embrace a translucent sheet of lesser area than said sash, one of the ends of said sash at the split being flexible for temporary displacement out of the normal plane of the sash and of the frame, to guide said sash from its normal position within the window frame upon rotating said split sash with its flexible end started out of the confines of the window frame.

7. In a centerless window structure of the class described, the combination which comprises: an open annular window frame of one-piece hoop construction comprising a continuous curved metallic element of channel formation having a pair of spaced parallel annular flanges directed radially inwardly, with a single uninterrupted smooth annular track disposed between said flanges, one of said annular flanges being cut away long a limited portion of its length to substantially the level of said track, a circular window sash fitted to the annular track within the frame, to bear against that annular flange of the frame which is opposed to the one having the cut-away portion, a translucent sheet carried by said sash, and a second circular sash fitted within the frame for rotational movement along the annular track, said second sash comprising a circular distortable strip of flexible material U-shaped in cross-section, said U-shaped strip having smooth opposed spaced legs, one in flatwise sliding contact against the first sash and the other in sliding contact upon the cut-away flange of the window frame, the legs of the strip being directed centerward of the sash, and a substantially semi-circular translucent sheet fitted to the strip of said second sash between the legs thereof, said second sash being distortable to the extent of enabling entry thereof into the window frame past that annular flange which is cut away along a portion of its length, to intimately contact the first mentioned circular window sash and said cut-away flange, within the window frame confines.

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